Geographic Information System

Application for

Public Health Preparedness

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Acknowledgements

I would like to thank David Whisenant for his expertise and cooperation in assembling the various data elements and operational software into a map book for the ESF-8 State Emergency Response Team members. It has been invaluable to have someone with his level of GIS training and skill as a member of our team. This project would not have been possible without him.

Problem Statement

Hazard and vulnerability analyses for the state of South Carolina, indicate that our >4.4 million residents (July, 2007 US Bureau of Census) and > 30 million vacationers could experience injury, loss of life or property due to numerous natural or technological hazards. Natural hazards like hurricanes, tornadoes, floods, dam failure and earthquakes have historically posed the greatest risks. Increased transportation of hazardous materials, including radiological spent fuel and low-level waste through our state is raising the risk of a technological disaster. South Carolina will soon be home to the most nuclear power plants in the county. We currently have four such facilities in the state, with others under construction and three located just across the state line in bordering states. Forty one of the forty six counties are impacted by the 10 or 50 mile emergency planning zones of at least one nuclear power plant. In addition, there is also a federal Department of Energy facility in the state. Additional information concerning potential hazards can be found in Appendix B.

As detailed in the *South Carolina State Emergency Operations Plan*, a disaster may occur with little or no warning, and may escalate far more rapidly than the local response organization or jurisdiction can handle. When this happens, the local jurisdiction turns to the state to help provide the assistance and resources needed to minimize the impact.

The State of South Carolina utilizes the Emergency Support Function (ESF) concept to task state agencies to coordinate or supply resources to the affected area(s). As Director of Emergency Management for the South Carolina Department of Health and Environmental Control, my role is to coordinate ESF-8, which is responsible for health and medical services including medical care, public health and sanitation, behavioral health,

and deceased identification and mortuary services. During a disaster response, it is imperative that the ESF-8 team has accurate, timely data.

Although the some of the information is relatively stable; i.e., the names and locations of the licensed health care facilities, we can experience unacceptable delays in acquiring the data. Internet access can be lost or slow, agency servers may be offline or we simply may not have enough staff to work on just data acquisition. This project is an effort to create, during a non-disaster planning phase, a solution that compiles the most frequently required data into a system which the team can use to generate rapid answers to some of our data challenges.

During disaster activations, our team typically moves from our agency buildings to the State Emergency Operations Center. We have experienced problems in the past in our attempts to access agency databases when we are working at another state agency. Also, there are times like the recent snow event when incidents are handled by individual(s) working from home.

One of the most common real-life examples of the need for timely decision making occurs when South Carolina is under threat of a hurricane. As the State Emergency Management Division, in conjunction with the National Hurricane Center, work to predict the path of the storm, ESF-8 initiates conference calls with the hospitals to insure situational awareness. Due to the significant costs and inconvenience involved with coastal evacuation, the Governor has to wait until the hurricane experts believe that South Carolina will suffer a direct hit before issuing evacuation orders. This means that decisions and responses have to occur quickly and accurately. Depending upon the

magnitude and projected path of the storm, the South Carolina Department of Health and Environmental Control (DHEC) may recommend that a hospital or nursing home be exempt from an evacuation order. In order to acquire some of the data necessary to make this recommendation, we created Critical Data Sheets. This was originally a paper form that provided the agency with information concerning out-of-county sheltering agreements and transportation plans for facilities moving their clients and staff as well as shelter-in-place information like elevation of the building, wind load capacity and caches of food, water, medicine and fuel (see Appendix C for additional information). Several years ago, this system was converted to a web based program managed by DHEC. South Carolina, like most other states, faces a deficiency in the number of transportation assets available for large-scale coastal evacuation. If the facilities are not able to obtain the buses, vans and/or ambulances needed, ESF-8 helps coordinate the acquisition of the assets. This is just one component in the decision making process.

Data Collection

Data elements were chosen for this project based on past need. I surveyed three other members of the ESF-8 state level team to identify those elements that were most important to include in the project. I used a hazard specific methodology to create the list of layers we are most likely to need. We started with hurricanes. This resulted in the inclusion of the Sea, Lake, and Overland Surges from Hurricanes (SLOSH) numerical model layers, hospital, nursing home and assisted living facility locations, and the Critical Data

Sheet System. The SLOSH layers indicate the expected inundation areas along the coast due to each of the five categories of hurricanes impacting the South Carolina coast. The Critical Data Sheet System as discussed above, is used by the hospitals and nursing homes located in the coastal counties to document their level of preparedness for dealing with hurricanes. Additional information that can be useful is the location of licensed health care facilities in relation to the pre-designated hurricane evacuation zones along the coast or by county. Prior to this project, this information was available by tasking a Geographic Information System (GIS) analyst with the question.

The fixed nuclear facility locations were added to help identify any licensed health care facilities which might have to be evacuated or shelter-in-place due to a potential release of radioactive material. The 10 and 50 mile emergency planning zones surrounding the facilities are also predetermined and included. The two hazardous dams that have received the most attention due to their potential to impact large numbers of residents are the Saluda Hydro Dam and the Santee North Dam. We were able to include the flooding inundation maps for both dams.

These layers along with the SC Department of Health and Environmental Control Region map were placed on a SC Department of Transportation state map with highways and county boundaries. The process of collecting the various data sets was much less involved than the process of assembling them into a single product. The data sets were readily available through DHEC's Office of Public Health Statistics & Information Systems (PHSIS).

Data Analysis

In order to insure that the collection of data layers would be accessible during a disaster David Whisenant, a GIS analyst with DHEC, placed the data on a DVD. He used the ArcReader 10 freeware as the operating system and included it on the DVD. This will allow team members to access the data utilizing any computer that is available to them.

Initial tests with the DVD were unsuccessful on my laptop. After the software failed to download from the vendor's website, we were able to install it on my computer and on the DVD from a hard copy disk kept by PHSIS. Although part of the Critical Data Sheet information was available by clicking on a location on the map, some of the elements critical for evacuation planning were missing. David was able to retrieve the missing information from the DHEC website and add it to the DVD.

Once the DVD was fully operational, we tested it by running various disaster scenarios for the various data sets. One scenario involved a dam release. During exercises we are always asked to identify any licensed health care facilities (LHCFs) that could be potentially impacted by inundation flooding. It is important to know which hospitals may have to evacuate and which ones may have to take in the patients from the affected area. The second scenario was to identify all LHCFs located in a 10 or 50 mile radius around a fixed nuclear facility.

Implementation

Inclusion of the DVD as part of the ESF-8 team toolbox will be will be readily accepted by the team members. Implementation will require minimal training once the software has been successfully loaded on the members' laptops. I will schedule a training session with the team this month so we can confirm that all team member laptops are able to load and run the program and that everyone knows how to access and utilize the data layers. The only cost associated with the project has been staff time. The stakeholders have been involved in identifying the required data sets. We have discussed integration of this new process into our standard operating procedures (SOPs). This still needs to be included in our operational checklist. A few additional DVDs will be prepared and held as backup resources.

Evaluation Method

Team members will participate in training, drills and exercises to evaluate the adequacy of this product. The goal is to have a final product prior to the start of hurricane season on June 1, 2011. Our team includes a Master Exercise Practitioner who will be able to help evaluate the product.

I have learned that another part of our agency has created a similar product but with different data sets. Part of our evaluation process will involve comparing the two GIS products and reviewing any guidance that has already been established for the other product.

Summary and Recommendations

It is important for a response team to pre-plan their needs in advance of a disaster. For ESF-8, that means knowing where the licensed health care facilities are in relation to the hazards which are most likely to interfere with their day-to-day operations. This product provides us with a standalone system that team members can each carry with them when they activate. It can be utilized either at the state or agency level or used at home, depending on the event.

As the team uses the product which is referred to as a map book, I am certain we will identify additional layers that we want to include. It will be important to keep the data in the map book current. We will need to set a review schedule. Since hurricanes present the most likely threat to South Carolina, I recommend that we update the data layers in mid-June after the health care facilities have updated their Critical Data Sheets and reviewed the data quarterly thereafter.

I anticipate that the data contained in the map book will be transferred to the encrypted jump drives utilized by the team. The DVD copies will be maintained as backup resources and will be password protected to protect the licensed health care facility data. Prior to the start of hurricane season, I would like to have the coastal evacuation zones added as individually reportable areas.

The problem encountered with loading ArcReader 10 on my computer, illustrates the need for a non-web based system for data processing. A procedure which should have required a few minutes to download from the Internet did not work. After multiple tries,

we were able to locate a disk containing the software and used it to install the software. This is the type of delay that causes tremendous stress and frustration when we are in the middle of an activation due to a real world event.

I do not expect the map book to totally eliminate the need for GIS support or current data, but I see it as a quick way for a team member to generate useful information in the midst of a disaster response. We may not always have the Internet or all of the data sources we need at our fingertips when decisions have to be made quickly. This tool will help us better serve the citizens and visitors in South Carolina should a disaster occur.

I have included examples of some of the data layers in the map book in Appendices D-F. Since the map book contains information about private hospitals and nursing homes, I have not included a DVD with this project.

Appendix A – Abbreviations

DHEC	South Carolina Department of Health and Environmental Control
ESF	Emergency Support Function- A functional emergency management area with a corresponding annex in the State Emergency Operations Plan and National Response Framework which tasks states and federal agencies to provide and/or Coordinate certain resources in response to emergencies or disasters.
ESF-8	Health and medical services to include medical care, public health, sanitation, behavioral health, and deceased identification and mortuary services.
GIS	Geographic information system
LHCF	Licensed health care facility. This includes hospitals, nursing homes and community residential care (assisted living) facilities.
SERT	State Emergency Response Team – A emergency management team consisting of State agencies and volunteer organizations designed to manage the state's response effort during emergencies and disasters. The team is organized in emergency support functions.
SLOSH	Sea, Lake, and Overland Surges from Hurricanes (SLOSH) are numerical models used by the National Hurricane Center to compute surge heights.

Appendix B – Hazard Analysis Summary

Hurricanes and Tropical Storms

- Six counties border the Atlantic Ocean.
- Forty-one percent of the state's population resided in the 23 coastal and low country counties in 2007.
- Inland flooding and storm surge pose the greatest threat to life and property.

Tornadoes

- SC averages 10-15 tornadoes each year.
- In 2004, SC experienced 89 tornadoes.

Coastal and Riverine Flooding

- Over 650 flood events have been reported in South Carolina's Storm Events Database since 1993.
- One hundred fifty-four of the events were caused by rainfall induced by tropical systems.

Nuclear Power Plants

- There are four commercial nuclear power plants and one federal Department of Energy facility in the state of South Carolina.
- Three nuclear facilities are located in two neighboring states
- Forty-one South Carolina counties fall within the 10 or 50-mile emergency planning zones of at least one nuclear power plant.

Earthquakes

- SC experiences several earthquakes annually.
- ~70 percent occur in the vicinity of the 1886 Charleston earthquake.

- The 1886 event was the most destructive US earthquake in the 19th century.

Fires

- In 2007, SC ranked fifth in the nation with 60 fire related deaths.
- People cause ninety-eight percent of all SC wildfires, with the leading cause being careless outdoor burning.
- The second leading cause of wildfire is woods arson.
- In a typical year, South Carolina responds to about 4,000 wildfires, which burn nearly 25,000 acres.

Hazardous Materials

- In 2007, 1,334 facilities reported storing extremely hazardous substances exceeding the Threshold Planning Quantity as classified by Section 302/304 of the Superfund Amendments and Reauthorization Act (SARA Title III).
- In 2007, approximately 3,457 facilities reported toxic chemical inventories of more than 10,000 pounds as classified by Section 311/312 of SARA, Title III.
- In January 2005, a rail accident in Graniteville caused a chlorine release resulting in nine fatalities, and the evacuation of hundreds of families.
- The Great Falls Warehouse Fire in June, 2006 displaced hundreds of families as a result of toxic, hydrogen chloride, smoke produced by the burning of polyvinyl chloride.

Terrorism

- SC has not been victim to any successful acts of terrorism to date.
- Recent national and international terrorist activity and its continued threat continue to reinforce potential dangers.

Transportation

- SC has a large transportation network consisting of major highways, airports, marine ports and passenger railroads.
- A major transportation accident can cause numerous injuries and/or fatalities.

Civil Disturbance

- Civil disturbances may occur at anytime in South Carolina.

Dam Failure

- SC has over 50,000 dams.
- 32 of those dams are federally regulated.
- 2,313 of the dams are regulated by the state.

Severe Winter Weather

- Winter storms can damage property and create safety risks.
- The greatest statewide 24-hour snowfall total of 24 inches occurred in the Town of Rimini in February 1973.

Droughts

- The 1998–2002 drought was one of the longest and most severe in more than 100 years.
- The farm losses from this drought total over $1 billion.

Extreme Heat

- Periods of temperatures exceeding 100 degrees occur in SC on average 4 times each year.
- Extreme heat results in an average of two deaths and hundreds of thousands of dollars of damage to agriculture annually.

Thunderstorms and Lightning

- SC experiences hundreds of thunderstorms with thousands of associated lightning strikes annually.

- Each year SC averages 5 deaths directly resulting from thunderstorm related events and lightning strikes.

Infectious Disease Outbreak or Other Public Health Emergency

- Can occur with little or no notice.

- May involve special requirements for disease surveillance; isolation and quarantine, social distancing; rapid delivery of vaccines, antibiotics, or antiviral drugs; allocation of limited medical resources and expansion of health care services to meet a surge in demand for care.

Additional information concerning hazard analysis is available in the *South Carolina Emergency Operations Plan* which is available at http://www.scemd.org/Plans/sceop.html

Appendix C – Critical Data Sheet

D H E C

Critical Data Sheet Summary Information
Sample Sheet

Facility Information

Address: _____

Date Filed: _____ Date of Expiration: _____

DHEC License Number: _____ Total no. of Licensed Beds: _____

Information of the Person Responsible for this Facility

Name: _____ Title: _____

Phone: _____ E-mail: _____

24/7 Emergency Contact Information

Phone: _____

Cell: _____ Pager: _____

Information of the Person Filling out this Data Sheet

Name: _____

Title: _____ Phone: _____

Facility Building

Maximum number of patients beyond capacity in case of an emergency: _____

Height in feet of the lowest part of the building above high tide sea level: _____

Building strength against maximum wind speed in miles per hour: _____

Certifier's name and address:

Emergency Generator

How often is the generator serviced? _____

Generator capacity(KVA): _____

Height of generator base above high tide sea level in feet: _____

How long will the generator run with a full tank of fuel?(hours) _____

Type of Fuel: _____

Fuel tank location: _____ feet above high tide sea level.

Fuel tank capacity in gallons: _____

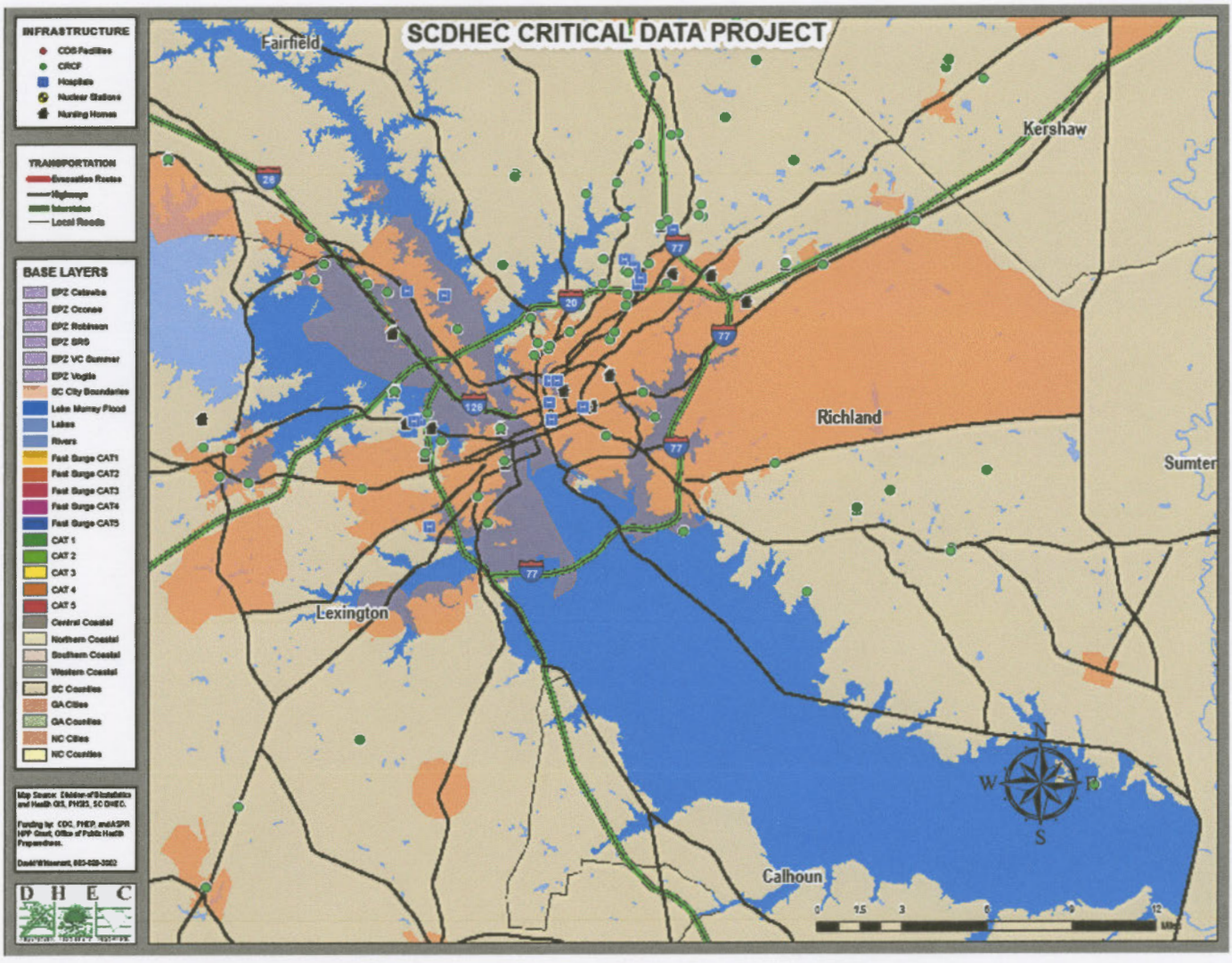
How often is the tank refilled?

Water, Food and Medical Supplies

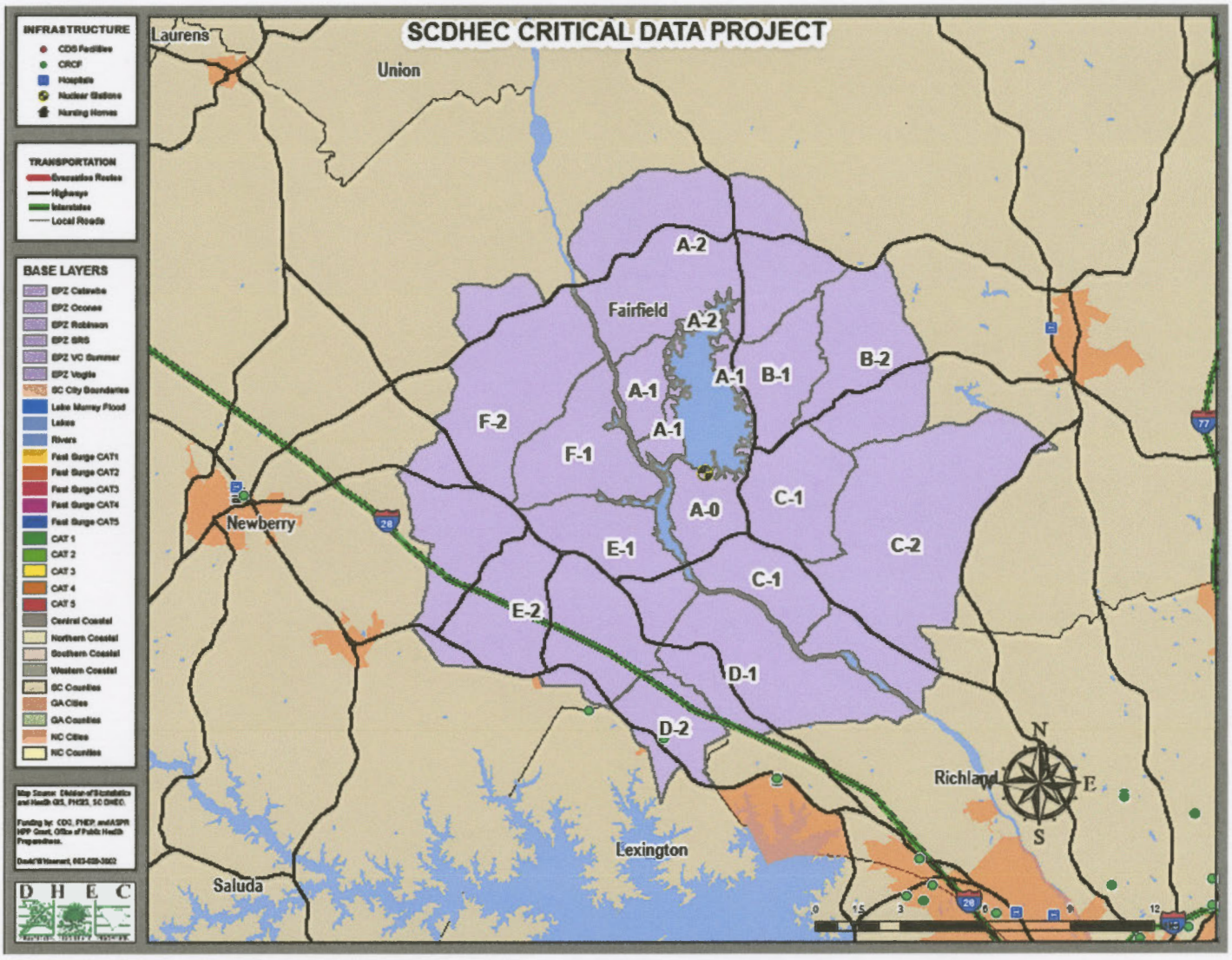
Is well water available on premises? No

Is a 72 hour drinking water supply available in the event of failure? No

Appendix D – Dam Break



Appendix E – Fixed Nuclear Facility Emergency Planning Zones



Appendix F – SLOSH